

seven stations) was 72.4 inches, as compared with the average, 79.5 inches. Notice is directed to an apparent connection between droughts in Natal and Mauritius, well-marked winter droughts at the coast stations of the former place being followed by summer droughts in Mauritius at intervals of from three to seven months.

We have received from the Deutsche Seewarte its monthly meteorological chart for the North Atlantic Ocean for September, which, like the corresponding chart published in this country, is repeat both on face and back with information of value to seamen, and includes notes on ice, fog, &c., brought down to the latest possible date. A comparison of the face of the English and German charts naturally exhibits slight differences in the results; this is unavoidable when compilation is made from data received from different sources. The back of the German publication contains, *inter alia*, charts showing the weather conditions between Ushant and Gibraltar, and sudden changes observed in the sea-surface temperature south of the Newfoundland Bank, each chart being accompanied with useful explanatory text.

THE Publications of the Japanese Earthquake Investigation Committee, Nos. 23 and 24, are devoted to an account and study of the seismograms of what is called the "Great Indian Earthquake of 1905." The preface states that these are issued as a systematised account of the instrumental observations of the earthquake, to be laid, for discussion, before the International Seismological Association at its next general conference. The data yielded by the seismograms are discussed with a wealth of elaboration and tabulation which tends to obscure the conclusions drawn; some of these are diametrically opposed to those generally held in this country, and the data on which they are based seem more consistent with the view that this earthquake was not so very "great," and that the distant records are imperfect. The value of the series of reproductions of forty-one seismograms taken at twenty-nine different stations would have been increased had the reproductions of Milne seismograms been less coarse in texture, but even with this drawback they form a collection which will be extremely useful to students of seismology, and we have only to regret that it should have been left to the Japanese Government to produce an adequate report of a British earthquake.

A NEW microphone for wireless telephony, the invention of Prof. Majorana, is described in the *Electrician* of August 30. The microphone consists of a jet of water falling on a collector made of two cylindrical pieces of platinum. The two pieces of platinum are connected to a battery, and a current passes depending on the thickness of the water film connecting the two surfaces; this thickness is varied by passing the stream of water before it falls on the collector through a receptacle, one side of which is formed by a membrane actuated in the ordinary manner of a telephone transmitter. It is stated that the vibrations produce corresponding fluctuations in the water jet, and the secondary current reproduces in consequence the sound waves. The collector circuit is connected to the spark-gap in the wireless transmitter, a Poulsen arc in nitrogen being the most suitable spark-gap to employ. No particulars are given of distances over which transmission has been accomplished.

THE *Halbmonatliches Literaturverzeichnis* of the *Fortschritte der Physik* continues to fulfil its function of bringing the titles of papers published in the various departments of physics promptly before its readers. It is interesting to notice that nearly 40 per cent. of the papers published fall within the section cosmothical physics,

THE general characteristics of the treatment of elementary geometry adopted by Messrs. Barnard and Child in their "New Geometry for Schools" (Messrs. Macmillan and Co., Ltd.) and similar volumes have been described in these columns on more than one occasion (vol. lxxix., pp. 96 and 391; vol. lxxi., p. 174). To meet the requirements of teachers and students who wish only to follow the subject up to particular standards, the course of work has been subdivided, and three new volumes containing various sections have recently been published. Part iii. of "A New Geometry" contains the equivalent Euclid, Books ii., iii. (35-7), and the harder parts of Book iv.; parts iii. and iv. (in one volume) include, in addition, Euclid, Book vi., and the algebraical treatment of ratio and proportion for commensurable quantities; and "A New Geometry for Middle Forms" contains the substance of Euclid, Books i.-iv., together with additional matter. The six volumes, which now form Messrs. Barnard and Child's series on practical and theoretical geometry for schools, provide students in any part of the Empire with courses of study which cover satisfactorily the revised syllabuses of examining bodies, and follow the reformed methods of geometrical teaching brought about by the reports of committees of the British Association and the Mathematical Association.

#### OUR ASTRONOMICAL COLUMN.

DANIEL'S COMET (1907d).—An excellent reproduction from a photograph, and a description of comet 1907d, are published in the September number (p. 385) of the *Bulletin de la Société astronomique de France* by M. F. Quénnisset, of the Juvisy Observatory. With a clear sky, the comet appeared incomparably brighter than the Andromeda nebula, and gave the impression of being about the brightness of a second-magnitude star; the tail could be seen, by the naked eye, extending to a distance of 8° or 10°. Between July 12 and August 15 twenty-six photographs were obtained, three portrait lenses of 16.0, 13.5, and 3.8 cm. aperture, and 0.740, 0.565, and 0.130 metre focal length, respectively, being chiefly employed. On these photographs the structure of the tail is very sharply defined, and on one obtained with the last-named objective the tail can be traced for not less than 17°. From the photographs obtained with this instrument on August 7 and 8 there is evidence of a rotatory motion of the comet about a line joining the nucleus and the sun.

As seen in the 24-cm. (10-inch) equatorial and on the photographs taken with a Viennet objective, the structure of the tail near the head was fan-like, the colour being a fine green, and the brightest part was directed towards the sun. A visual examination of the comet with a spectroscope revealed the three strong hydrocarbon bands on a brilliant background of continuous spectrum. These bands were sharply defined on the red side, and faded away gently towards the violet, and, on replacing the spectroscope slit, they, with others, were seen resolved into lines; the order of their brightness was green, blue, orange.

From Mr. G. Gillman, of Aguilas (Spain), we have received a drawing showing the observed path of the comet from August 13 to 21. On the former date Mr. Gillman, as shown on his drawing, was able to trace the tail for a distance of 25° in a W.S.W. direction.

Owing to its decreasing brightness and to the fact that it does not rise until about 1½ hours before sunrise, the comet is becoming a difficult object, but we give below a further extract from the ephemeris published in No. 4196 (p. 337, August 23) of the *Astronomische Nachrichten*:—

#### Ephemeris 12h. (Berlin M.T.).

	1907	$\alpha$ (true) h. m.	$\delta$ (true)	$\log r$	$\log \Delta$	Bright- ness
Sept. 21	...	10 46.3	... +7 5.1	... 9.8179	... 0.1879	... 6.4
23	...	10 55.7	... +6 25.8			
25	...	11 4.8	... +5 47.1	... 9.8550	... 0.2085	... 4.9

As mentioned last week (p. 503), Herr Kritzing, of Berlin, recently pointed out (*Astronomische Nachrichten*, No. 4198) that the radiant point of this comet was in  $346^{\circ}+1^{\circ}$  on September 12. Mr. W. F. Denning informs us that he watched the sky on September 10, 12, and 14, the weather being very clear, but did not notice any meteoric shower from the point mentioned. There was an active radiant at  $355^{\circ}+5^{\circ}$ , however, about ten degrees E.N.E. from the position given by Herr Kritzing. This display is often seen in September, and there is another at  $346^{\circ}+1^{\circ}$  (exactly agreeing with the cometary radiant), often noticed both in August and September. The correspondence in the apparent places is probably accidental.

Mr. A. J. Hawkes writes from Bournemouth to suggest that the fine sunsets seen on Monday, and also at the end of last week, may be due to meteoritic dust in the track of the comet recently crossed by the earth.

THE LOWELL EXPEDITION TO THE ANDES.—In a recent communication to Dr. W. J. S. Lockyer, Prof. David Todd briefly describes the location and work of the Lowell expedition to the Andes for the purpose of observing Mars under the best conditions during the last opposition. Prof. Todd states that he selected Cerro Alizana, in northern Chili, for the location of the Amherst College 18-inch telescope, one of the instruments sent out by Prof. Lowell, and has found the atmospheric condition most favourable. Cloudless skies obtained day and night, and a windless and steady atmosphere produced an average "seeing" of 4 on a scale of 5. More than 5000 photographs, covering all regions of the planet, were obtained by Mr. E. C. Slipher, and many of them exhibit clearly the much discussed double canals. The telescope is the last one, of large size, erected by Messrs. Alvan Clark and Sons, and their chief mechanic, Mr. A. G. Ilse, is a member of the expedition. Photographs of the annular eclipse on July 10 were also secured, and the ringless phase of Saturn was much observed and photographed. Prof. Todd removed the station to a point in the higher Andes above Limas during the first week in August.

MARKINGS ON THE THIRD SATELLITE OF JUPITER.—In No. 4199 of the *Astronomische Nachrichten* (p. 381, September 6) Senor J. Comas Solá continues his description of the markings he has observed on Jupiter's third satellite, and gives position angles determining the positions of the same, at stated times, with regard to the direction of the axis of rotation of the planet. From the discussion of his results he concludes, provisionally, that (1) the visibility of the northern white cap is independent of the satellite's position in regard to the planet, and is incomparably greater than that of the other cap; its brightness is comparable to the snow-caps of Mars. (2) As on Mars, the northern cap of satellite III. is always bordered by a dark area, which appears darker nearer to the cap. (3) The northern cap appears to be turned towards us, and, if it is situated at the extremity of the axis of rotation of the satellite, the inclination of the equatorial plane to the orbit of the satellite must be considerable. (4) The dark spots and areas are difficult to observe, and appear to be variable in a very short time. (5) As yet nothing can be said of the rotation period of the satellite.

A plate of twelve drawings accompanies the paper, and shows very markedly the different features referred to, and their variations from time to time, as observed during the period November 24, 1906, to March 25, 1907.

ASTROPHYSICAL OBSERVATIONS AND ANOMALOUS DISPERSION.—In Nos. 4197-8 (p. 341, September 2) of the *Astronomische Nachrichten*, Prof. Hartmann discusses at length the possible explanation of several observed astrophysical phenomena by the theory of anomalous dispersion. He first discusses the general problem, and then its effect in the observed phenomena of the chromosphere, sun-spots, prominences, faculae and flocculi, and the fixed stars. The results of the discussion are not universally conclusive, but Prof. Hartmann points out that, with stated conditions, the question may be decided by special observations. A bibliography of fifty-six papers on this subject is given at the end of the discussion.

#### FORTY YEARS OF CORNISH MINING.

MY connection with Cornish mining began in the year 1867, when I succeeded the late Sir Clement (then Dr.) Le Neve Foster as lecturer and assistant secretary to Mr. Robert Hunt's Miners' Association of Cornwall and Devon. It was a time of transition, for copper-mining after a brilliant career of a century or more was rapidly declining, and tin-mining, which though far more ancient had become second in importance, was once more in the ascendant. The man-engine, the employment of which had been greatly assisted a quarter of a century earlier by substantial prizes offered by the Royal Cornwall Polytechnic Society, was in use in a dozen of the principal mines, wire-rope and skip were gradually replacing chain and kibble, and rock-boring machines, thanks to the initiation of my predecessor, had already been practically tested in several parts of the county. These were real advances, but kibble-winding was still common even in the deepest mines; the cobbing hammer, the bucking iron, the hand-jigger, and the wooden shafted stamp were still at work to a large extent; while the stonebreaker, the California and pneumatic stamp, the various forms of pulveriser, the Frue and Luhrig vanners, the Wilfley and Buss tables, the self-acting and round slime frames, the air-compressor, and many other contrivances which are now looked upon as essentials in well-provided mines were only beginning to appear. When one compares the present condition of Cornish mining with its condition forty years ago, it is obvious that a sort of revolution has taken place.

In mining proper there has been no great advancement during the forty years. Somewhat greater depths have been attained in a few instances, and notably at Dolcoath, but Cornwall is still far behind several other mining regions in this respect. We are now more impressed than heretofore with the advantages afforded by good shafts, good underground roads, and good surface transport; the tramroad and tram-wagon have largely displaced the wheelbarrow; underground ore-bins, once so rare, are now becoming common; but in the main our system of underground mining was so good even a century ago that there was not very much room for improvement. Still, I will venture to predict that during the next forty years more vertical shafts will be sunk, that levels will be driven farther apart, that there will be a great deal more cross-cutting, and that our underground tramroads will be better constructed, so that "three men at a wagon" will be no more heard of.

As to the methods employed for breaking the ground, the chief changes have resulted from the use of boring machines and high explosives. In 1868 I first saw Doering's machine at work in Tincroft Mine. It was not a success, for, being operated by steam, the workings were rendered almost unbearable; in fact, while steam was the motive power, the use of the machine drill made very little progress either at home or abroad, and it is certain that if compressed air had not been introduced boring machines would to-day play a very small part in mining or tunnelling. Once introduced, however, the immense value of the system was at once recognised.

The difference between "to-day" and "yesterday" is seen in the fact that no rock-drill or air-compressor has ever been employed in the great mining parish of Gwennap, several of whose mines were still at work a generation ago, while at present all the great mines of the neighbouring parishes of Camborne and Illogan depend very largely upon these machines, not because they break the ground more cheaply, for it is well known that such is not the case (and, moreover, in narrow lodes they do not even break the ground more advantageously, for the "pay-streak" inevitably becomes much contaminated with barren "country"), but because they open the ground more speedily. One good effect of their employment has been the enlargement of the main drifts, and consequent improved ventilation, and this has been especially benefited by the large amount of cool exhaust air set free by the machines. The greater number of machine drills hitherto have been employed in sinking, rising, or drifting, but there is a constant and growing tendency to employ them in stoping also.

Forty years ago much gunpowder was still used in the